

DetNet Data Plane

DetNet Data Plane design team

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Outline

- Design team update
- Solution
- Hard/Open issues
- Next steps

Design team

- Members
 - Jouni Korhonen (lead)
 - Carlos Bernardos
 - Loa Andersson
 - Yuanlong Jiang
 - Norm Finn
 - Balazs Varga
 - Janos Farkas
 - Tal Mizrahi
 - David Mozes

Design team update cont'd

- Weekly calls held... And some slideware used extensively to build common understanding & consensus.

Covered use cases

- Interconnect TSN islands case

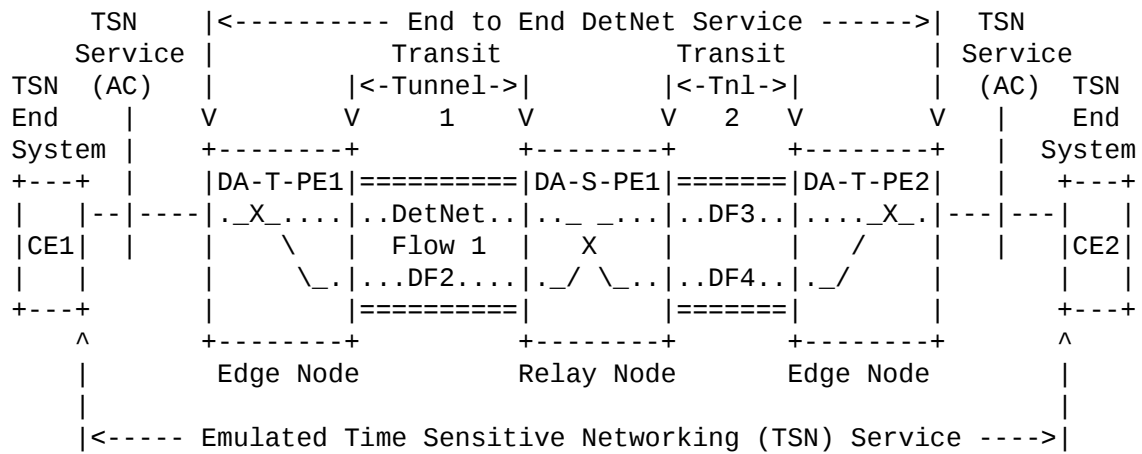


Figure 2(*): IEEE 802.1 TSN over DetNet

- End-to-end DetNet service

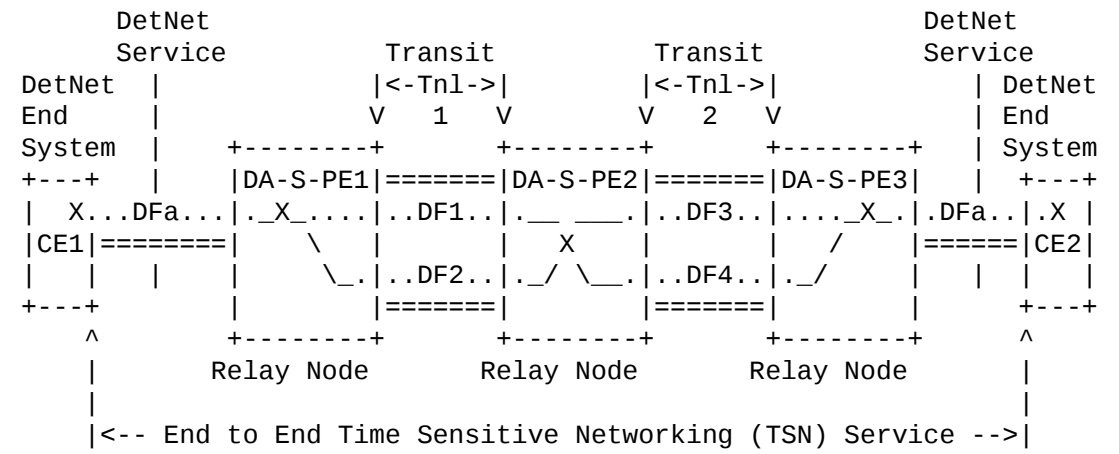


Figure 3(*): Native DetNet

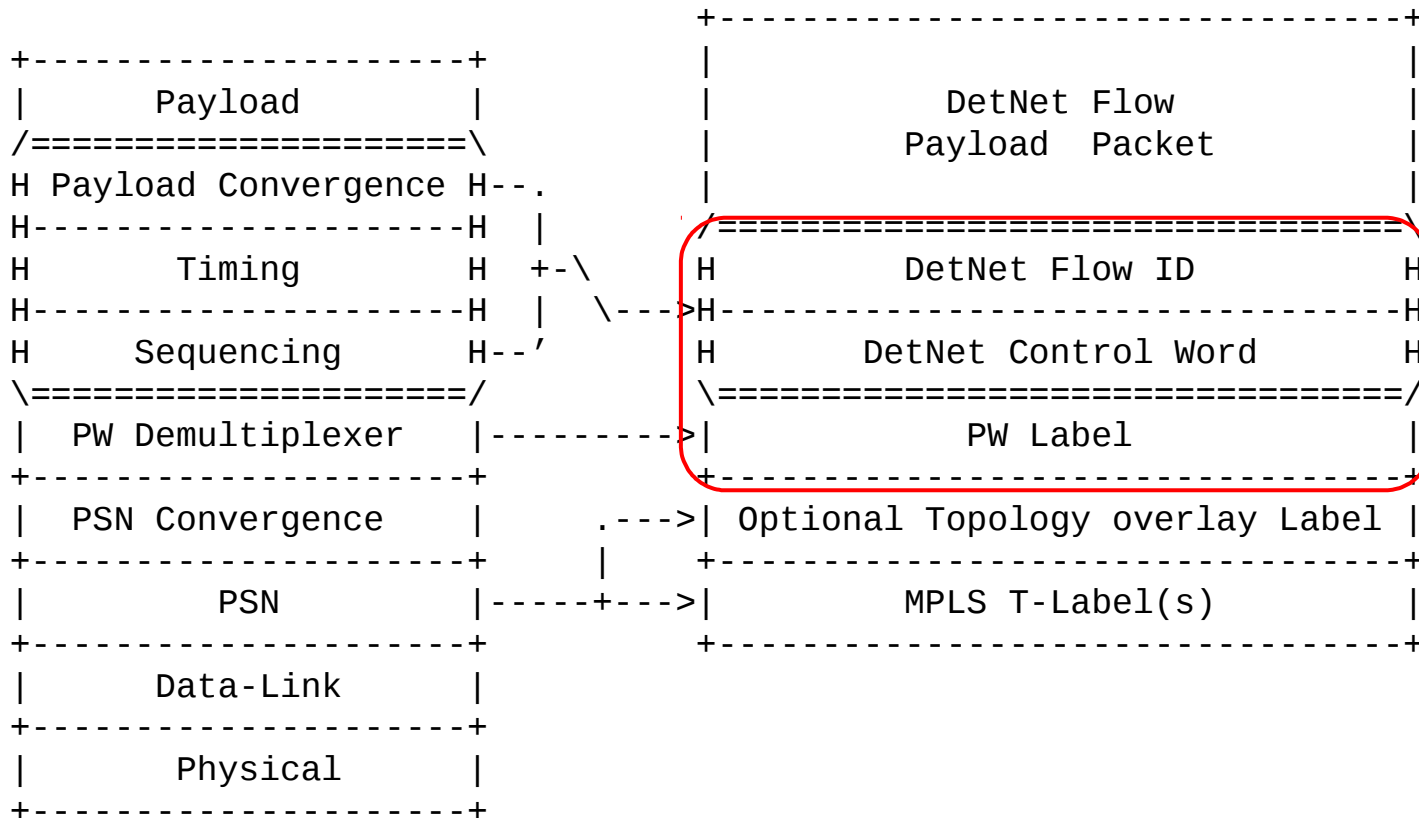
Solution basics

- Leverages RFC6073 Multi-Segment PseudoWires.
- Allows both IP and MPLS PSNs.
- Designed to work with existing control planes, e.g. LDP, RSVP-TE, SR and centralized controller.
 - Small updates are inevitable, though.
- Maximize the reuse of existing solutions and implementations:
 - Extend only where needed & mandatory for solution to work.
 - No new functionality unless really necessary.
- Main functions & body of work:
 - Map DetNet Edge node to a DetNet aware MS-PW T-PE -> DA-T-PE.
 - Map DetNet Relay node to a DetNet aware MS-PW S-PE -> DA-S-PE.
 - Add DetNet flow identifications -> PW encapsulation header carries a Flow-ID.
 - Add DetNet packet replication and elimination -> PW CW seqnum is a must.

Packet formats with MPLS PSN

RFC3985 Encapsulation

DetNet PW Encapsulation



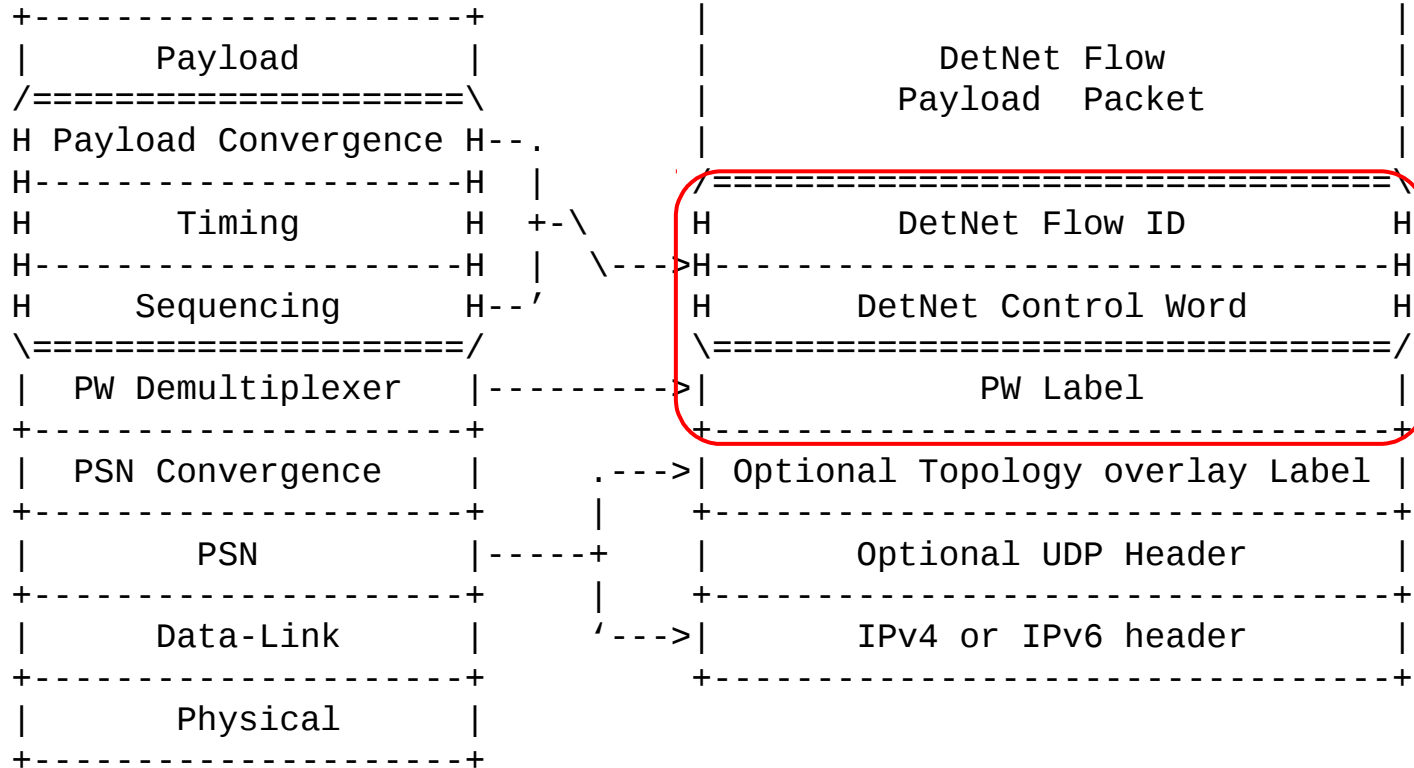
- DetNet data plane encapsulation:
 - Always has a PW label.
 - Always has a CW.
 - Always has a Flow-ID.

- Topology “L-label” for overlays to connect only desired set of PE nodes:
 - Exposes PW label only when needed.
 - A node can be treated as a P node or a PE node within an overlay.

Packet formats with IP PSN

RRC3985 Encapsulation

DetNet PW Encapsulation



- DetNet data plane encapsulation:

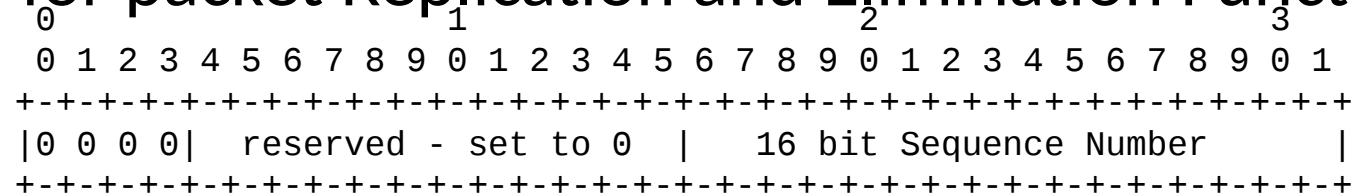
- Always has a PW label.
- Always has a CW.
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- Topology “L-label” for overlays to connect only desired set of PE nodes:

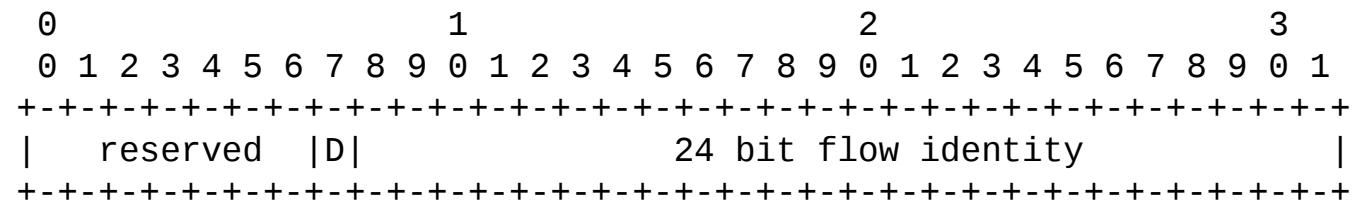
- Exposes PW label only when needed.
- A node can be treated as a P node or a PE node within an overlay.

Packet formats cont'd

- PW Control Word is the same as for Ethernet over MPLS (RFC4448).
- Required for packet Replication and Elimination Function (PREF).



- The DetNet PW encapsulation header also carries a DetNet Flow-ID.
- The Flow-ID is unique within the DetNet Network.
- The Flow-ID identifies (over multiple flows) which packets belong to a same flow and also share the same SeqNum space for PREF purposes.
- D-flag can be used to indicate “east/west” for the flow – implicitly part of Flow-ID.

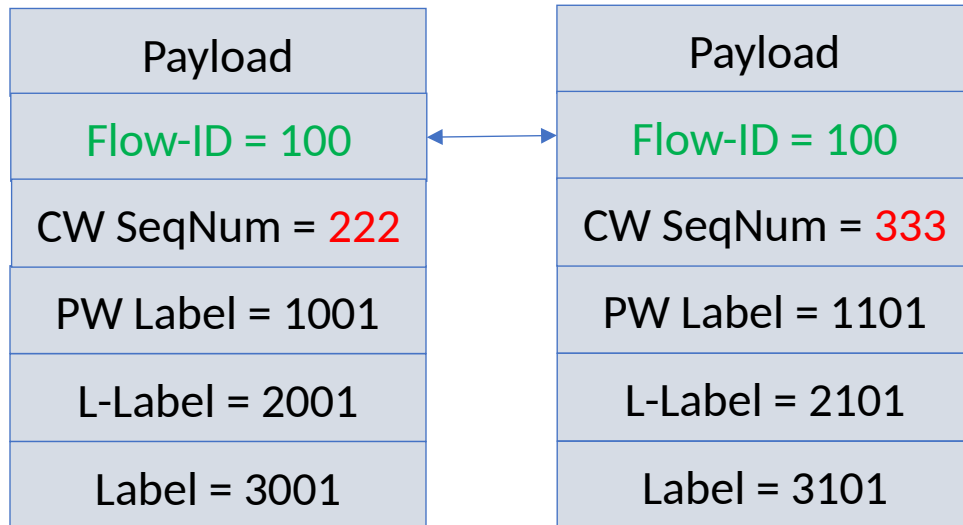


Flow identification..

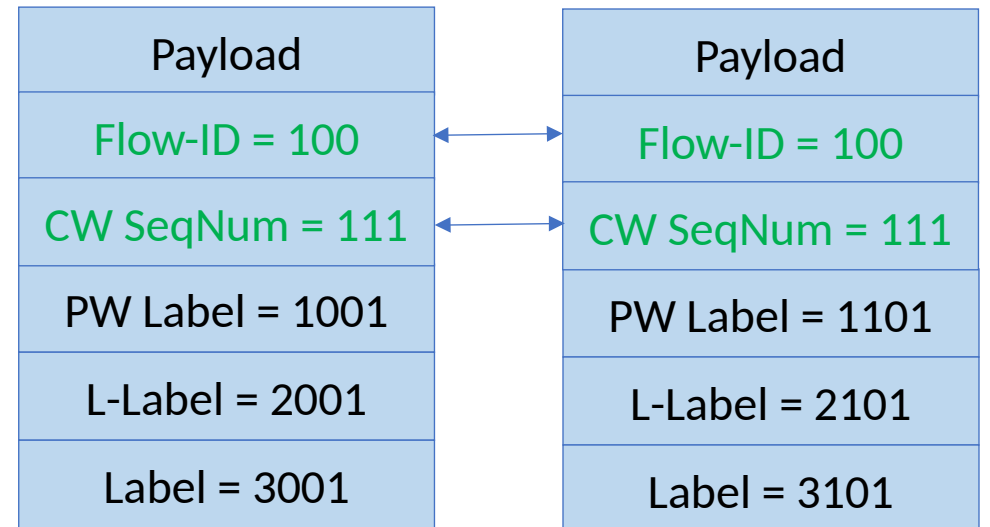
- Integral part of DetNet flow processing. Flow identification has two key aspects (MPLS PSN example):
 - At the **forwarding and queuing level**:
 - Flow identification implicitly part of FEC and encoded into label(s) and TC bits.
 - May identify an aggregate of DetNet flows or individual flows (e.g., a FEC per flow).
 - As **part of the Packet Replication and Elimination Function**:
 - Flow lookup based on the Flow-ID PW header field and accompanied with the CW SeqNum to detect whether a packet has already be seen.
 - Done within the PseudoWire (extended forwarder) function.
 - Note: replication is basically a reuse of 1+1 protection mechanism.

Flow identification example..

- Same DetNet flow, different packets in the flow:

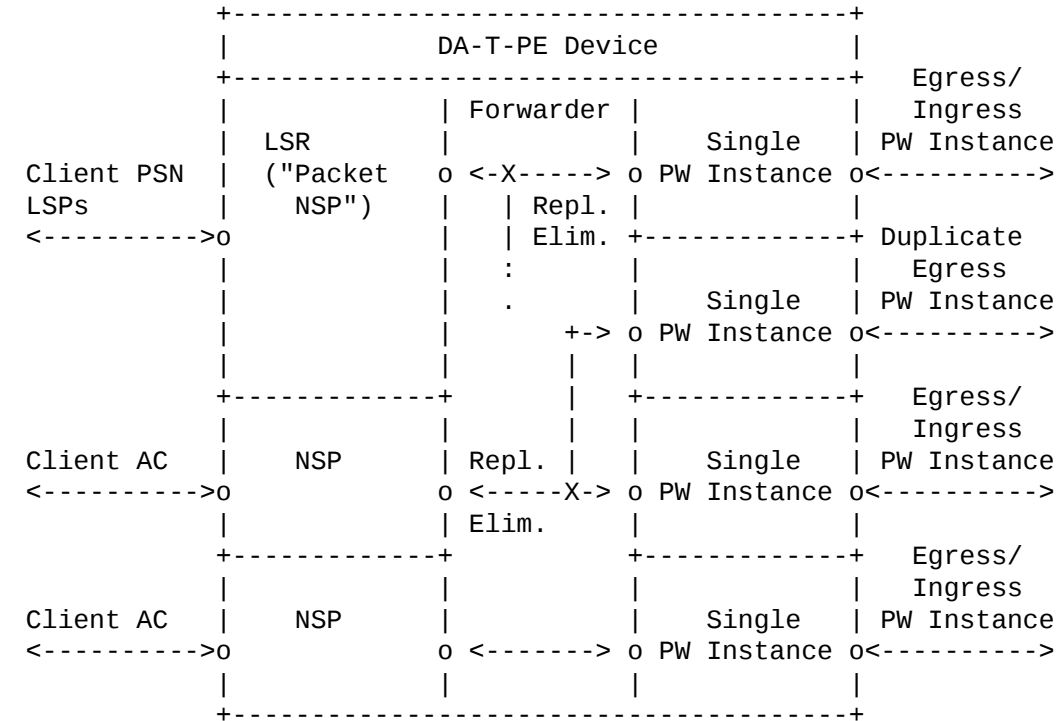


- Same DetNet flow, duplicate packets of the flow:



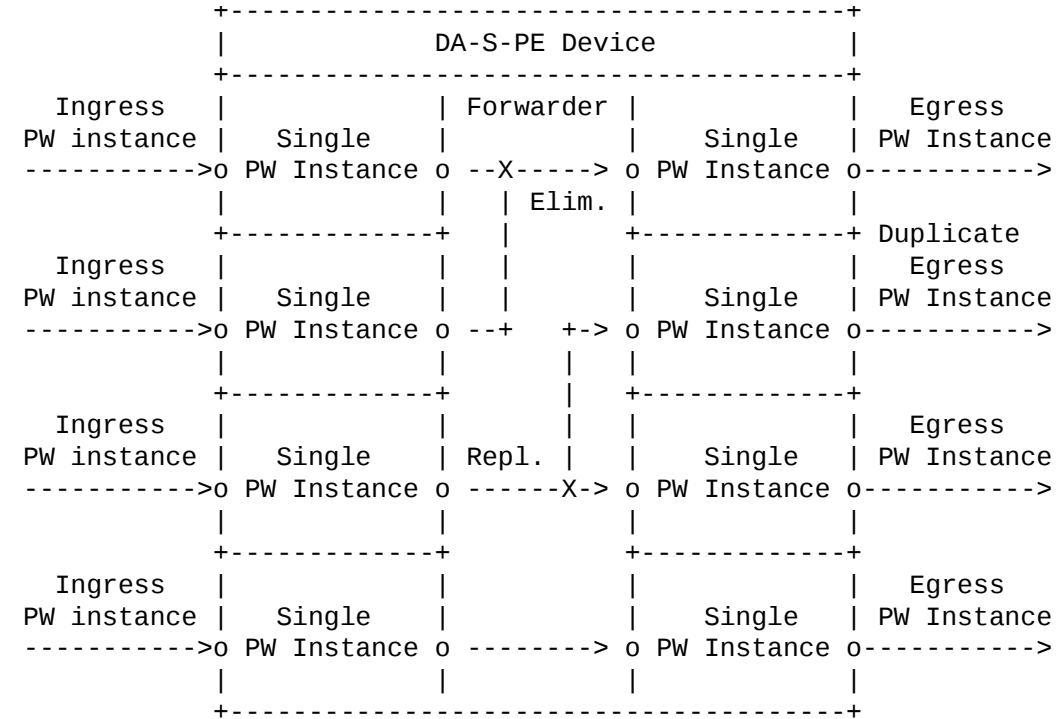
DA-T-PE – a DetNet Aware T-PE

- A MS-PW T-PE with a DetNet Edge Node function:
 - Can originate/terminate both normal and DetNet PWs. A subject to LFIB configuration.
- Participates to the packet replication and duplication elimination (PREF):
 - In certain deployment cases and subject to DA-T-PE implementation PREF can also be done entirely within the NSP.
- Does the DetNet flow to PW Flow-ID mapping:
 - Inserts/removes the PW encapsulation layer.
 - SeqNum may be locally maintained or copied over from the client flows (e.g., in a case of 802.1CB traffic).



DA-S-Boo^H^H^HPE – a DetNet Aware S-PE

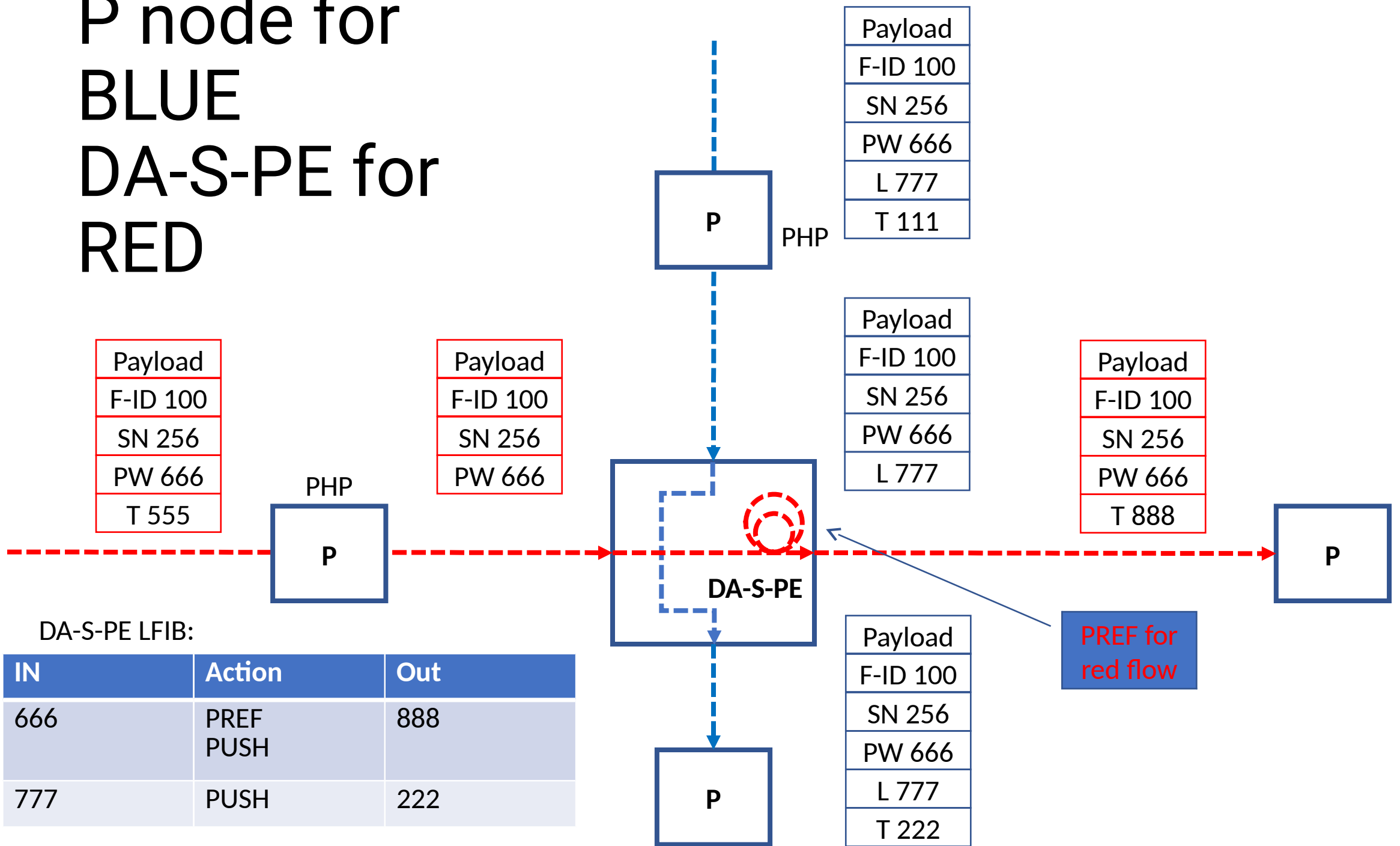
- A MS-PW S-PE with a DetNet Relay Node function:
 - Can switch both normal and DetNet PWs. A subject to LFIB configuration.
- Participates to the packet replication and duplication elimination (PREF):
 - Whether the PW goes through PREF depends on the LFIB configuration. In order to PREF taking place the PW label has to be on top of stack..
 - Example on the next slide.



P node for BLUE

DA-S-PE for RED

DA-S-PE for RED



Hard issues

- Packet Replication and Elimination Function (PREF) turned out to be a hard thing to get things sorted out:
 - It needs new functionality in PE nodes.
- Assignment and coordination of DetNet Flow-IDs when the network has multiple ingress and egress T-Pes:
 - However, this is something for control planes to figure out.

Open issues

- No real open issues at the moment at the data plane.
- Few topics are still under work:
 - QoS/CoS sections in the document.
 - Whether L-Labels (overlay) is needed in all cases - there are deployment cases where L-Labels can be avoided i.e., topologies are such that no DetNet flow need to treat a PE node as a P node.
- Control plane is another topic... out of scope for this I-D. However...
 - The design team did consider it as well to some extent.
 - TLV extension are likely needed, e.g., to prevent Flow-IDs from colliding.
 - Controlling PREF function, resource reservations, etc...

Next steps..

- Call for adoption as a WG Item.